PATENT ABSTRACTS OF JAPAN

(11)Publication number : 06-295601

(43)Date of publication of application : 21.10.1994

(51)Int.Cl. F21M 3/18
B60Q 1/14
H04N 7/18

(21)Application number : 05-081692

(22)Date of filing : 08.04.1993

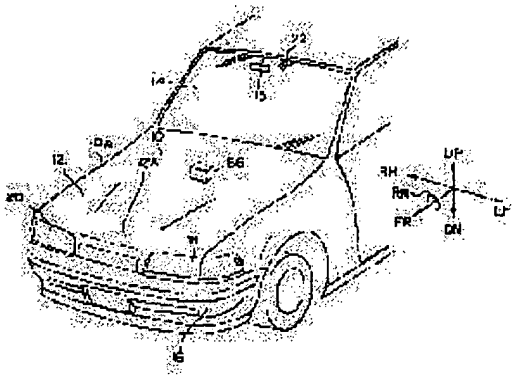
(71)Applicant : TOYOTA MOTOR CORP

(72)Inventor : MIZUKOSHI MASASHI

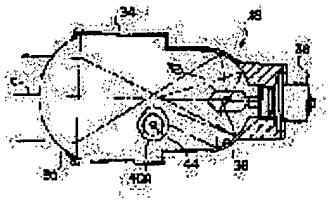
(54) HEADLIGHT FOR VEHICLE

(57)Abstract:

PURPOSE: To prevent headlights from giving glare to a preceding vehicle by detecting the preceding vehicle by the image signal of the front of a vehicle, and detecting the position, according to the illumination of a head lamp.



CONSTITUTION: A TV camera 22 for picking up the image of the situation before a vehicle is arranged in the vicinity of a room mirror 15. The light of a bulb 32 being reflected and condensed with a reflector 38 is shaded with a shading cum 40A of an actuator, and the light excluding it is projected from a lens 30. The cum 40A is rotated by a motor being driven, according to the signal from a controller. Accompanying this rotation, the position of the boundary where the light of the bulb 32 is divided into a passing light and a shaded light changes up and down. This boundary appears as the cut line as the boundary between light and darkness in the light distribution in front of the vehicle 10. The position of the cut line shifts parallel from the position corresponding to the top to the position corresponding to the bottom by the cum 40A being rotated.



LEGAL STATUS

[Date of request for examination] 06.04.1999

[Date of sending the examiner's decision of rejection] 13.08.2002

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] the object for vehicles characterized by providing the following -- a headlight -- equipment The head lamp which can change either [at least] the direction of radiation or the irradiation range An image pck-up means to picturize the situation ahead of vehicles and to output a picture signal A detection means to detect precedence vehicles based on the picture signal outputted from the aforementioned image pck-up means, and to detect the height position of the boundary of the portion by which the light of the aforementioned head lamp which adjoins the field corresponding to the aforementioned precedence vehicles in a picture along the vehicles vertical direction is irradiated, and the portion which is not irradiated Control means which control either [at least] the direction of radiation of the aforementioned head lamp, or the irradiation range so that the height position of the aforementioned boundary detected by the aforementioned detection means becomes below predetermined height to precedence vehicles

---

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] this invention -- the object for vehicles -- a headlight -- the vehicles which control the luminous intensity distribution of the head lamp which starts equipment and irradiates the front of vehicles during a vehicles run especially -- a headlight -- it is related with equipment
[0002]
[Description of the Prior Art] Couple arrangement of the head lamp is carried out at vehicles right-hand side and on the left-hand side of the vehicles front end section, when it is difficult to check a front situation by looking like night, the light is switched on, and the front visibility of a driver is raised. When this head lamp has the common composition which the irradiation range can change only to two stages of a high beam and a low beam and the other cars, such as precedence vehicles and opposite vehicles, exist, a low beam is chosen in many cases so that the unpleasant glare which makes the driver of the other car dazzle may not be given. however -- cases, like the distance between two cars with precedence vehicles is long, for example -- a low beam -- a driver -- irradiation of a head lamp -- continuing and viewing dark space out of range, by the high beam, always irradiating the suitable range of front had the problem of being difficult, like giving a glare to precedence vehicles etc.
[0003] For this reason, the gobo for shading irradiation light is prepared in the interior of a head lamp, without giving a glare to the other car, the aforementioned gobo is moved so that sufficient irradiation range may be acquired, and controlling the position of the boundary (this boundary is hereafter called cutline) of an irradiation field and a non-irradiated field is proposed. moreover, it considers as the technology which controls the position of a cutline so that a glare may not be given to the other car, the situation ahead of vehicles is picturized by the CCD camera etc., precedence vehicles are recognized based on the picture signal outputted from a CCD camera, the distance between two cars with precedence vehicles is detected, and controlling the luminous intensity distribution of a head lamp according to the distance between two cars is proposed (refer to Provisional-Publication-No. 62 No. -131837 official report)
[0004] Moreover, replacing with detection of the distance between two cars based on a picture signal, detecting the distance between two cars and controlling by the radar like the above is also proposed.
[0005]
[Problem(s) to be Solved by the Invention] however, in the control of a cutline based on the above-mentioned distance between two cars As opposed to a target cutline [gap / the attaching position of a headlight] position the positions of an actual cutline differ or When a relative position with precedence vehicles changes with the inclination of vehicles, the inclination of a road surface, etc., the relation between the distance between two cars and the position of a suitable cutline changes, a glare may be given to precedence vehicles, or the irradiation range may be insufficient and the visibility ahead of vehicles may fall.
[0006] the object for vehicles which can prevent that accomplished this invention in consideration of the above-mentioned fact, and it gives a glare to precedence vehicles -- a headlight -- it is the purpose to

obtain equipment
[0007]
[Means for Solving the Problem] the object for vehicles which starts this invention in order to attain the above-mentioned purpose -- a headlight -- equipment The head lamp which can change either [at least] the direction of radiation or the irradiation range, Precedence vehicles are detected based on the picture signal outputted from an image pck-up means to picturize the situation ahead of vehicles and to output a picture signal, and the aforementioned image pck-up means. A detection means to detect the height position of the boundary of the portion by which the light of the aforementioned head lamp which adjoins the field corresponding to the aforementioned precedence vehicles in a picture along the vehicles vertical direction is irradiated, and the portion which is not irradiated, It has the control means which control either [at least] the direction of radiation of the aforementioned head lamp, or the irradiation range so that the height position of the aforementioned boundary detected by the aforementioned detection means becomes below predetermined height to precedence vehicles.
[0008]
[Function] For example, in a projector type head lamp, the boundary (namely, cutline) of the portion (bright section) by which the light from a head lamp is irradiated, the portion (dark space) by which light is not irradiated, and ** appears comparatively clearly. For this reason, precedence vehicles are detected based on the picture signal showing the situation ahead of the vehicles outputted from the image pck-up means, and it is made to detect the height position of the boundary of the portion by which the light of the head lamp which adjoins the field corresponding to the precedence vehicles in a picture along the vehicles vertical direction is irradiated, and the portion which is not irradiated in this invention.
[0009] Although the bright portion and the dark portion adjoin, for example along the vehicles vertical direction in the field corresponding to the precedence vehicles in a picture also in the edge portion of the tail lamp of precedence vehicles The boundary of the irradiation portion and the non-irradiating portion which are produced by the headlight Usually, by making applicable to detection only the boundary which is continuing more than predetermined length along the vehicles cross direction, for example, is continuing more than predetermined length It is not incorrect-detected, using the edge section of a tail lamp as a cutline, only a cutline can be extracted and the height position can be detected.
[0010] And either [at least] the direction of radiation of a head lamp or the irradiation range is controlled by this invention so that the height position of the detected aforementioned boundary becomes below predetermined height (for example, height of the tail lamp of a precedence vehicle) to precedence vehicles. Thus, since the luminous intensity distribution of a head lamp are controlled based on the height position of the cutline which detected and detected the height position of a cutline itself And a relative position with precedence vehicles changes with the inclination of vehicles, the inclination of a road surface, etc., or [that the distance between two cars changes] [that the attaching position of a head lamp has shifted] It can prevent certainly also in **, giving a glare at precedence vehicles, since the position of the cutline to precedence vehicles can be made below into predetermined height.
[0011]
[Example] Hereafter, with reference to a drawing, the example of this invention is explained in detail. as shown in drawing 1 , the engine hood 12 arranges in the upper surface section of front body 10A of vehicles 10 -- having -- **** -- the front end section of front body 10A -- the vehicles cross direction -- once -- since -- the other end is covered and the front bumper 16 is being fixed The head lamps 18 and 20 of a couple are arranged in vehicles cross direction both ends between this front bumper 16 and the first transition section of the engine hood 12.
[0012] Windshield glass 14 is formed near the back end section of the engine hood 12, and the room mirror 15 is formed in it near the part corresponding to the upper part side of the windshield glass 14 of the vehicles 10 interior. TV camera 22 for picturizing the situation ahead of vehicles near the room mirror 15 is arranged. TV camera 22 is connected to the image processing system 48 (refer to drawing 4). The TV camera which outputs the picture signal which is equipped with the CCD element which detects only the quantity of light as TV camera 22, and expresses monochrome picture with this example is used.

[0013] In addition, as for the arrangement position of TV camera 22, it is desirable to be arranged in the position near [as possible] the view position (the so-called eye point) of a driver so that the passage configuration ahead of vehicles can be recognized correctly and it may agree by visual feeling of a driver. Moreover, the passage configuration corresponding to one lane formed with a configuration, for example, the center line, a curbstone, etc. of an advance way is included in the passage configuration in this example.
[0014] Moreover, the speedometer which is not illustrated is arranged by vehicles 10 and the vehicle speed sensor 66 (refer to drawing 4) which detects the vehicle speed V of vehicles 10 is attached in the cable of this speedometer that is not illustrated. It connects with the image processing system 48, and this vehicle speed sensor 66 outputs the detection result of the vehicle speed V.
[0015] As shown in drawing 2 and drawing 3 , a head lamp 18 is a projector type head lamp, and is equipped with the convex lens 30, the bulb 32, and the lamp house 34. The lamp house 34 is being fixed to the frame which vehicles 10 do not illustrate by the abbreviation horizontal, and a convex lens 30 is fixed to one opening of a lamp house 34, and the bulb 32 is being fixed to opening of another side through the socket 36 so that the point emitting light may be located on the optical axis L of a convex lens 30 (medial axis of a convex lens 30).
[0016] The reflector 38 of an ellipse reflector is formed in the bulb side of the lamp house 34 interior, it is reflected by the reflector 38 and the light injected from the bulb 38 is condensed between a convex lens 30 and a bulb 32. The actuator 40 is arranged in this condensing neighborhood of a point. The actuator 40 equips the axis of rotation 44 fixed so that it might meet crosswise [vehicles] in a lamp house 34 with shading cam 40A supported to revolve possible [rotation], and gearing 40B has fixed to this shading cam 40A. In gearing 40B, gearing 40C which fixed to the driving shaft of motor 40D has geared. Motor 40D is connected to the driver 64 of a control unit 50.
[0017] The light of the bulb 32 by which reflective condensing was carried out by the reflector 38 is shaded by shading cam 40A of an actuator 40, and the other light is injected from a convex lens 30. The distance from the axis of rotation 44 to a periphery is carrying out the cam configuration which changes continuously along with a circumferencial direction, and shading cam 40A rotates, when motor 40D drives according to the signal from a control unit 50. The position of the boundary where the light of a bulb 32 is divided by passage light and the shaded light changes up and down with rotation of this shading cam 40A. It will appear as a cutline (cutline 70 shown in drawing 5) this boundary of whose is a boundary of the light and darkness in the luminous intensity distribution ahead of vehicles 10.
[0018] As shown in drawing 5 , the position of a cutline 70 is moved to parallel from the position (the position shown in drawing 5 as a solid line as a cutline 70, position below the so-called high beam) corresponding to the most significant to the position (the position shown in drawing 5 with a fictitious outline, position of the so-called low beam average) corresponding to the least significant, when shading cam 40A rotates. Moreover, since a head lamp 20 is the same composition as a head lamp 18, although detailed explanation is omitted, the actuator 41 is attached as shown in drawing 4 . The actuator 41 is equipped with shading cam 41A which is not illustrated, and the position of a cutline is moved with rotation of shading cam 41A.
[0019] As shown in drawing 4 , the control unit 50 is constituted including the buses 62 which connect a read-only memory (ROM) 52, RAM (RAM) 54, a central processing unit (CPU) 56, input port 58, an output port 60, and these, such as a data bus and a control bus. In addition, the map and control program which are mentioned later are memorized by this ROM52.
[0020] The vehicle speed sensor 66 and the image processing system 48 are connected to input port 58. This image processing system 48 carries out the image processing of the image picturized by TV camera 22 based on the signal inputted from TV camera 22 and a control unit 50 so that it may mention later. The output port 60 is connected to the actuator 40 of a head lamp 18, and the actuator 41 of a head lamp 20 through the driver 64. Moreover, the output port 60 is connected also to the image processing system 48.
[0021] Next, an operation of this example is explained with reference to the flow chart of drawing 6 and drawing 7 . If a driver turns on the light switch which vehicles 10 do not illustrate and head lamps 18

and 20 are made to turn on, the control main routine shown in drawing 6 for every predetermined period will be performed. At Step 300 of this control main routine, precedence vehicles recognition processing is performed and the precedence vehicles precede with self-vehicles and it is running are recognized. This precedence vehicles recognition processing is explained with reference to the flow chart of drawing 7 .

[0022] When vehicles 10 are running the road 122, an example (image 120) of the image which carried out abbreviation coincidence with the picture checked by looking by the driver picturized by TV camera 22 is shown in drawing 8 (A). This road 122 equips with the white line 124 the both sides of the lane vehicles 10 run. In addition, a position is pinpointed by the coordinate (Xn and Yn) of the system of coordinates which become settled by the X-axis by which each pixel on the above-mentioned image was set up on the image, and which intersects perpendicularly respectively, and the Y-axis. Below, recognition of precedence vehicles is performed based on this image.

[0023] At Step 400, the field which has the predetermined width of face gamma on an image as shown in drawing 9 is set up as a white line detection window field Wsd. In this example, the white line of the position which crosses 60m of front of vehicles 10 in consideration of only the picture to the abbreviation 40-50m ahead of vehicles 10 being undetectable at the time of a night run of vehicles 10 is not detected. Moreover, for the field of the lower part in a picture, the accuracy in which precedence vehicles exist is a low. For this reason, the white line detection window field Wsd which removed the downward field from a 140 or more-horizontal line predetermined field and the predetermined minimum line 130 is set up so that the white line detection window field Wsd can be detected even for 60m even of front of vehicles 10.

[0024] At the following step 402, the inside of the window field Wsd is differentiated about brightness, and the peak point (the maximum point) of this differential value is extracted as an edge point which is a white line candidate point. That is, the inside of the window field Wsd is differentiated [pixel / each / horizontal perpendicularly (the direction of drawing 9 arrow A)] about the brightness from the pixel of the lowest position to the pixel of the best position, and change of a luminosity extracts the peak point of a big differential value as an edge point. The edge point which continues by this like the dashed line 132 shown in the window field Wsd of drawing 9 as an example is extracted.

[0025] Straight-line approximation processing is performed at Step 404. This processing carries out straight-line approximation of the edge point extracted by white line candidate point sampling processing using the Hough (Hough) conversion, and asks for the approximation straight lines 142 and 144 which met the line presumed to be a white line. intersection PN which asked for and asked for the intersection PN of the approximation straight line for which it asked (X coordinate value =XN) at the following step 405 a horizontal variation rate with the intersection P0 (X coordinate value =X0) of the approximation straight line in the case of the straight-line way which is made into criteria and which was appointed beforehand -- an amount A (A=XN-X0) is calculated This amount A of displacement corresponds to the degree of the curve of a passage 122.

[0026] At the following step 406, the amount A of displacement is A2 >=A>=A1. A passage 122 judges whether it is an abbreviation straight-line way by judging whether it is within the limits. This criterion value A1 It is a reference value showing the boundary of a straight-line way and a right curve way, and is the criterion value A2. It is a reference value showing the boundary of a straight-line way and a left curve way. When judged with a straight-line way at Step 406, the vehicle speed V of the self-vehicles 10 is read at Step 408.

[0027] Vehicles recognition field WP which recognizes precedence vehicles at the following step 410 according to the read vehicle speed V Amendment amendment width-of-face alphaL and alphaR are determined for the position of an approximation straight line in setting up. At the time of a high-speed run, even if the direct front of vehicles is a passage near an abbreviation straight line since the radius of curvature which can circle is small at the time of a low-speed run, although it can consider that it is running the passage of an abbreviation straight line, since the radius of curvature of the passage in which vehicles can circle is large, when the radius of curvature of a passage is small at the distant place, vehicles are the vehicles recognition fields WP. Shell deviation may be carried out. For this reason,

aforementioned amendment width-of-face alphaL and alphaR Using a map as shown in drawing 12 , it is determined that a value becomes large as speed V becomes low.
[0028] the following step 412 -- the minimum line 130, amendment width-of-face alphaL, and alphaR Vehicles recognition field WP for carrying out recognition processing of the precedence vehicles for the field surrounded in the approximation straight lines 142 and 144 by which the position was amended ****** -- it determines (refer to drawing 10) In addition, this vehicles recognition field WP Aforementioned amendment width-of-face alphaL according to change of the vehicle speed V and alphaR even if it attaches With change, area is enlarged as it becomes a low-speed run (refer to drawing 11).
[0029] if the judgment of Step 406 is denied on the other hand -- Step 414 -- setting -- A>A2 ****** -- by judging, a passage judges a right curve way or a left curve way They are amendment width-of-face alphaL according to the vehicle speed V which the passage was judged to be a right curve way, read the vehicle speed V of vehicles 10 at Step 416, and was read using the map shown in drawing 12 when a judgment was affirmed, and alphaR. Receiving correction value alphaL' and alphaR' are determined at Step 418. the variation rate which expresses the degree of a curve with the following step 420 -- an amount A -- responding -- amendment width-of-face alphaR of an approximation straight line on either side, and alphaL correction value alphaR' which determined the gain GL and GR for determining using the map shown in drawing 13 and drawing 14 , and was determined at Step 422, and alphaL -- ' and the gain GL and GR -- being based -- final amendment width-of-face alphaR of right and left of a window field, and alphaL It determines.
[0030] At this time, since a passage is a curve way, it becomes unsymmetrical [right and left], and the approximation straight lines 142 and 144 serve as a different inclination. For this reason, amendment width-of-face alphaR on either side and alphaL It is set as the independent value. That is, the accuracy to which precedence vehicles exist [a passage] in right-hand side when radius of curvature is small (the amount [Variation rate] A size) is high on a right curve way. Therefore, it is amendment width-of-face alphaR by enlarging right-hand side gain GR. It is amendment width-of-face alphaL by enlarging (referring to drawing 13) and making left-hand side gain GL small. It is made small (refer to drawing 14). Moreover, when radius of curvature is large (the amount [Variation rate] A smallness) and a passage makes right-hand side gain GR small on a right curve way, it is amendment width-of-face alphaR. It is amendment width-of-face alphaL by making it small and enlarging left-hand side gain GL. It enlarges. Change of this amendment width of face is shown in drawing 15 as an image.
[0031] amendment width-of-face alphaL determined at Step 424, and alphaR Vehicles recognition field WP for carrying out recognition processing of the precedence vehicles for the field surrounded in the approximation straight lines 142 and 144 by which the position was amended ****** -- it determines
[0032] On the other hand, when the judgment of Step 414 is affirmed, it judges that a passage is a left curve way, and shifts to Step 426, and the vehicle speed V of vehicles 10 is read. At Step 428, it responds to the vehicle speed V read using the map of drawing 12 , and they are correction value alphaR' on either side and alphaL'. It determines and the gain GL and GR of the right and left according to the amount A of displacement is determined at Step 430. That is, when radius of curvature is small (the amount [Variation rate] A size) and a passage makes right-hand side gain GR small on the map shown in drawing 16 on a left curve way since the accuracy to which precedence vehicles exist in left-hand side is high, it is amendment width-of-face alphaR. It is amendment width-of-face alphaL by enlarging left-hand side gain GL on the map which makes small and is shown in drawing 17 . It enlarges.
[0033] Correction value alphaR' determined at the following step 432, and alphaL' And gain GL, It is based on GR and they are final amendment width-of-face alphaR of right and left of a window field, and alphaL. It determines. amendment width-of-face alphaR of the right and left determined at Step 434, and alphaL Vehicles recognition field WP for carrying out recognition processing of the precedence vehicles for the field surrounded in the approximation straight lines 142 and 144 by which the position was amended ****** -- it determines
[0034] It is the vehicles recognition field WP as mentioned above. If determined, it will shift to Step

436, and it is the vehicles recognition field WP as recognition processing of precedence vehicles. Inner level edge-detection processing is performed. This level edge-detection processing is the vehicles recognition field WP about detecting a level edge point like edge-detection processing of Step 402 first. It carries out inside. Next, peak point EP of a position that integrate with the detected level edge point in a longitudinal direction, and an integration value exceeds a predetermined value It detects (refer to drawing 8 (B)). This level edge has high possibility of appearing when precedence vehicles exist.
[0035] The position coordinate of precedence vehicles is calculated at the following step 438. Perpendicular edge-detection processing is performed first. peak point EP of the integration value of a level edge point Peak point EP of being caudad located on a picture when there are more than one from -- order -- peak point EP The window field WR for detecting a vertical line so that the ends of the level edge point included may be included respectively, and WL It sets up (refer to drawing 8 (C)). This window field WR and WL When the perpendicular edge was detected inside, and vertical lines 138R and 138L are stabilized and are detected, they are the window field WR and WL. It judges with precedence vehicles existing in the field across which it faced.
[0036] Next, the window field WR and WL By asking for the interval of the longitudinal direction of the vertical lines 138R and 138L detected in inner each, it asks for breadth of a car, the coordinate of the center of breadth of a car is searched for as a coordinate of the center of vehicles, and the distance between two cars Len is calculated further. Precedence vehicles recognition processing is ended by the above, and it shifts to Step 302 of the flow chart of drawing 6 .
[0037] At Step 302, it judges whether precedence vehicles were detected by above-mentioned precedence vehicles recognition processing. When the judgment of Step 302 is denied, it shifts to Step 306, and according to the distance between two cars Len with precedence vehicles, the angle of the shading cams 40A and 41A is changed, and the position of a cutline 70 is controlled. This control searches for the gain over actuators 40 and 41 using a map as shown in drawing 18 as an example, and is performed by driving actuators 40 and 41 according to this gain. Thereby, the angle of the shading cams 40A and 40B is controlled so that the position of a cutline 70 moves upwards as the distance between two cars Len with precedence vehicles becomes large. In addition, since precedence vehicles do not exist at this time, the angle of a shading cam is unconditionally rotated to the predetermined angle corresponding to a high beam.
[0038] Moreover, when the judgment of Step 302 is affirmed, it shifts to Step 304, and the distance between two cars Len with the precedence vehicles detected by precedence vehicles recognition processing judges whether it is smaller than the predetermined distance A (for example, 100m) defined beforehand. When the judgment of Step 304 is denied, it shifts to Step 306, and position control of the cutline according to the above-mentioned distance between two cars is performed.
[0039] the predetermined field in the picture corresponding to [on the other hand, when the judgment of Step 304 is affirmed, shift to Step 308, and resemble the distance between two cars Len and the perpendicular edge of the precedence vehicles detected by precedence vehicles recognition processing, and it is based, and] the tail section of precedence vehicles -- window field WS ****** -- it sets up This window field WS Perpendicular edge 138L of the couple detected in precedence vehicles recognition processing as shown in drawing 19 (A) as an example, When horizontal line 150A which connects the soffit section of 138R is set up and horizontal line 150B is set as the position which separated only the distance d according to the distance between two cars Len with precedence vehicles from this horizontal line 150A It can consider as the field surrounded with these horizontal lines 150A and 150B and perpendicular edges 138L and 138R. In addition, the value is set to become small as the distance between two cars Len becomes large so that Distance d may not give a glare to precedence vehicles, when the position of a cutline 70 is located up a little rather than horizontal line 150B.
[0040] Window field WS set up above at the following step 310 Image data [inside] is changed into binary data on the basis of a predetermined threshold. When the cutline 70 is located in the position shown in drawing 19 (A) as an example, the portion which the portion by which the light of a head lamp is irradiated, and the portion (portion except the portion shown by hatching from Field WS) corresponding to the tail lamp of precedence vehicles show by the bright section and hatching is judged

to be dark space, and is changed into binary data. At Step 312, it is the window field WS. Inner binary data are differentiated perpendicularly and a differential value detects the value more than constant value. By this differential, it is the window field WS. A differential value turns into a value more than constant value at the point corresponding to the boundary of the bright section and dark space which adjoin along with an inner perpendicular direction, and a point as shown in drawing 19 (B) as an example is detected.

[0041] At Step 314, the differentiating point detected at Step 312 meets horizontally using the Hough (Hough) conversion, carries out straight-line approximation of the point more than constant value, and asks for the approximation straight line presumed to be a cutline. In addition, this straight-line approximation is the window field WS. It carries out from the upper part only to the point corresponding to the boundary which is changing to the bright section from dark space toward a lower part. Thereby, when the point corresponding to the edge section of the tail-lamp bottom of precedence vehicles in a differential value is detected as a point more than constant value, straight-line approximation is not performed to this point. Moreover, the edge section of the aforementioned tail-lamp top is the window field WS. Although it is changing from the upper part to the bright section from dark space toward a lower part, since the edge of this top is not continuing more than predetermined length, it can prevent being incorrect-detected as a cutline by removing a straight line with short length.

[0042] At Step 316, it judges whether it succeeded in straight-line approximation. Height position Xi of the approximation [when the judgment of Step 316 is affirmed, shift to Step 320, and] straight line in a picture It calculates. height position Xi of the approximation straight line detected at Step 322 this time Height position Xi-n of the approximation straight line detected n times ago from -- it judges whether it is changing or not The control main routine of this example is performed for every predetermined period, and it moves the position of a cutline each time so that it may mention later. therefore, height position Xi of an approximation straight line Height position Xi-n of n times ago from -- when not changing, it is possible to be the straight line in which the detected approximation straight line appeared according to the pattern of the bumper of precedence vehicles etc. In this case, the judgment of Step 322 is denied, it shifts to Step 306, and the cutline position according to the distance between two cars Len with precedence vehicles is controlled.

[0043] On the other hand, when the judgment of Step 322 is affirmed, it can be judged that the detected approximation straight line is a cutline 70. In this case, it shifts to Step 324. In addition, the judgment of Step 322 is affirmed when an approximation straight line is not detected in front of n times. When the judgment of Step 322 is affirmed, the value of the approximation improper counter FC established on memory at Step 324 is set to "0."

[0044] At Step 326, it judges whether the shading cams 40A and 40B were rotated so that the height position of a cutline 70 might move in the fall direction by control of the last cutline. When the judgment of Step 326 is affirmed, it shifts to Step 328, and the shading cams 40A and 40B are rotated so that the position of a cutline 70 may carry out specified quantity movement in the fall direction again. Moreover, when the judgment of Step 326 is denied, it shifts to Step 330, and the shading cams 40A and 40B are rotated so that the position of a cutline 70 may carry out specified quantity movement in the elevation direction. Therefore, by performing Step 328 or Step 330 of this main routine repeatedly, while the cutline 70 is detected, the angle of the shading cams 40A and 40B is controlled so that a cutline 70 moves towards specified quantity [every] regularity.

[0045] Moreover, the position of a cutline 70 is the window field WS by continuing movement in the fixed direction of a cutline 70. Since it becomes impossible to detect a cutline 70 when shell deviation is carried out, the judgment of Step 316 is denied, and it shifts to Step 332. At Step 332, "1" is added to the approximation improper counter FC. Therefore, while the cutline 70 is not detected, as for the approximation improper counter FC, a value will be enlarged gradually. At the following step 334, it judges whether the value of the approximation improper counter FC became larger than the approximation improper threshold value B. When the judgment of Step 334 is denied, it shifts to Step 336, and the value of the approximation improper counter FC judges whether it is more than "2."

[0046] When the cutline 70 detected to last time is no longer detected, the judgment of Step 336 is

denied, and it judges whether the shading cams 40A and 40B were rotated so that the height position of a cutline 70 might move in the fall direction by control of the last cutline. The shading cams 40A and 40B are rotated so that it may shift to Step 340 when the judgment of Step 338 is affirmed, and the move direction of a cutline 70 may be reversed, namely, so that the position of a cutline 70 may carry out specified quantity movement in the elevation direction. Moreover, when the judgment of Step 338 is denied, the shading cams 40A and 40B are rotated so that the move direction of a cutline 70 may be reversed at Step 342, namely, so that the position of a cutline 70 may carry out specified quantity movement in the downward direction.

[0047] Moreover, in case this main routine is performed next, the judgment of Step 336 is affirmed and it shifts to Step 326, and a cutline 70 is moved in the same direction (direction reversed by last time in this case) as the move direction of the last cutline 70 at Step 328 or Step 330. When this continues movement in the fixed direction of a cutline 70 as mentioned above and the position of a cutline 70 deviates from the window field WS, the position of a cutline 70 is Window WS. The angle of the shading cams 40A and 40B will be controlled to return inside.

[0048] Thus, when a cutline 70 is detected again, the judgment of Step 316 is affirmed again, and a cutline 70 is moved in the same direction as last time at Step 328 or Step 330. Therefore, while the cutline 70 is detected normally, the position of a cutline 70 is the window field WS. It controls to move in the fixed direction the specified quantity every in inside, and a cutline 70 is the window field WS. If it passes through inside and a cutline 70 is no longer detected, the move direction of a cutline 70 will be reversed, and it moves in the direction as for which the cutline 70 carried out reversal the specified quantity every, and is the window field WS. It controls to pass through inside

[0049] Thus, window field WS which the cutline 70 set up on the basis of the position of precedence vehicles in this example It is controlling to be located inside and the position of a cutline 70 is the window field WS. When it is judged that it became higher than upper horizontal line 150B, the position of a cutline 70 is reduced. therefore -- that, as for the position of the cutline 70 to precedence vehicles, the attaching position of a head lamp has shifted, or a relative position with precedence vehicles changes with the inclination of vehicles, the inclination of a road surface, etc. **** -- etc. -- it will be controlled to always become a case below predetermined height

[0050] Since a cutline 70 is no longer detected, even if it carries out predetermined time (B approximation improper threshold value) execution of this main routine, when a cutline 70 is undetectable on the other hand, the judgment of the above-mentioned step 334 is affirmed, it shifts to Step 306, and control of the cutline position according to the distance between two cars Len with precedence vehicles is performed.

[0051] In addition, although it had gone detection of the distance between two cars Len with precedence vehicles by this example based on the position of precedence vehicles in a picture, it is not limited to this, the direction where precedence vehicles exist based on the aforementioned picture is detected, and you may make it measure the distance between two cars by ranging meanses, such as a radar.

[0052] Moreover, although this example explained the case where the cutline 70 of the configuration shown in drawing 5 was detected to the example, it is also possible to apply, when detecting the cutline 90 of the configuration toward which the portion corresponding to the left-hand side of an irradiation field receives horizontally, and inclines in the left riser, as this invention is not limited to this and shown in drawing 20 as an example. Moreover, it is also possible to constitute so that the height position of the cutline corresponding to the right-hand side of an irradiation field and the height position of the cutline corresponding to the left-hand side of an irradiation field may be controlled respectively independently.

[0053] Moreover, although the luminous intensity distribution ahead of vehicles were controlled by the shading cam, you may make it shade the light of a head lamp by the gobo or the shutter in the above-mentioned example. Moreover, although luminous intensity distribution are controlled by shading the light of a head lamp, you may make it deflect the injection optical axis of a head lamp.

[0054]

[Effect of the Invention] Precedence vehicles are detected based on the picture signal which picturized the situation ahead of vehicles and was acquired in this invention as explained above. The position of

the boundary of the portion by which the light of the head lamp which adjoins the field corresponding to the precedence vehicles in a picture along the vehicles vertical direction is irradiated, and the portion which is not irradiated is detected. Since either [at least] the direction of radiation of a head lamp or the irradiation range was controlled so that the position of the detected boundary became below the predetermined height that does not give a glare to precedence vehicles The outstanding effect that it can prevent giving a glare to precedence vehicles in various situations at the time of a vehicles run is acquired.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the perspective diagram which looked at the vehicles in which the vehicles anterior part used for this example is shown from the slanting front.
[Drawing 2] It is the perspective diagram showing the outline composition of the head lamp which can apply this invention.
[Drawing 3] III-III of drawing 2 It is the cross section which met the line.
[Drawing 4] It is the block diagram showing the outline composition of a control unit.
[Drawing 5] It is an image view for explaining the cutline displaced with an actuator.
[Drawing 6] It is a flow chart explaining the control main routine of this example.
[Drawing 7] It is a flow chart explaining the detail of precedence vehicles recognition processing.
[Drawing 8] The conceptual diagram for the image view of a picture where (A) is picturized by the TV camera at daytime, and (B) explaining level edge point integration processing, and (C) are the conceptual diagrams for explaining perpendicular edge-detection processing.
[Drawing 9] It is the diagram showing the window field at the time of white line recognition.
[Drawing 10] It is the diagram showing a vehicles recognition field.
[Drawing 11] It is an image view for explaining fluctuating a vehicles recognition field according to the vehicle speed.
[Drawing 12] It is the diagram showing the relation between the vehicle speed and the amendment width of face of an approximation straight line.
[Drawing 13] It is the diagram showing a relation with the gain which determines the amendment width of face of the approximation straight line of the degree of a right curve way, and right-hand side.
[Drawing 14] It is the diagram showing a relation with the gain which determines the amendment width of face of the approximation straight line of the degree of a right curve way, and left-hand side.
[Drawing 15] It is the image view showing the window field and amendment width of face to a curve way of different curvature.
[Drawing 16] It is the diagram showing a relation with the gain which determines the amendment width of face of the approximation straight line of the degree of a left curve way, and right-hand side.
[Drawing 17] It is the diagram showing a relation with the gain which determines the amendment width of face of the approximation straight line of the degree of a left curve way, and left-hand side.
[Drawing 18] It is the diagram showing a relation with the gain for determining the rotation angle of the shading cam of the distance between two cars and an actuator.
[Drawing 19] (A) is the window field WS set as the tail section of precedence vehicles. The shown image view and (B) are the image views for explaining the process of cutline detection processing.
[Drawing 20] It is the image view showing other examples of the configuration of a cutline.
[Description of Notations]
18 Head Lamp
20 Head Lamp
22 TV Camera

40 Actuator
41 Actuator
48 Image Processing System
50 Control Unit
70 Cutline
90 Cutline
100 Run Vehicles Detection Equipment

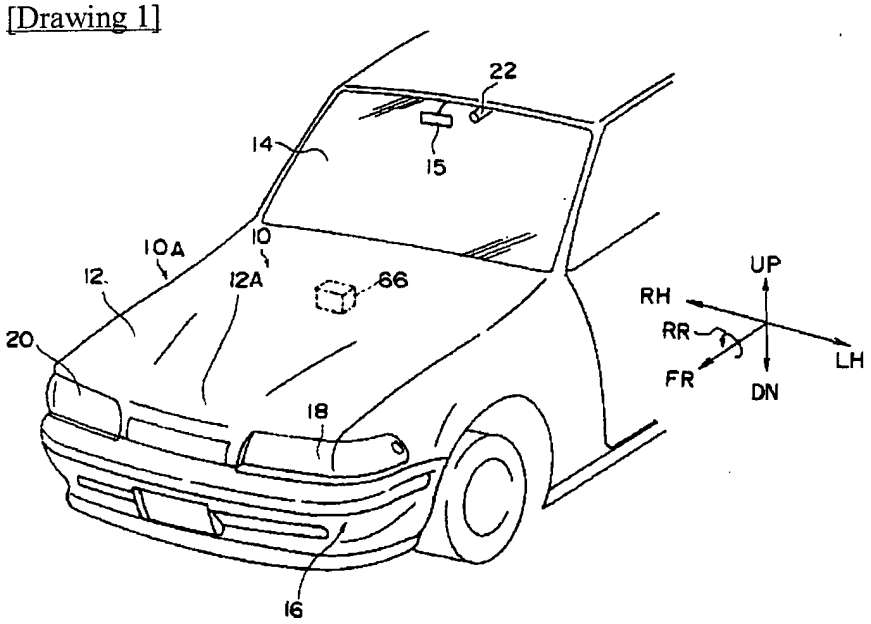
[Translation done.]

* NOTICES *

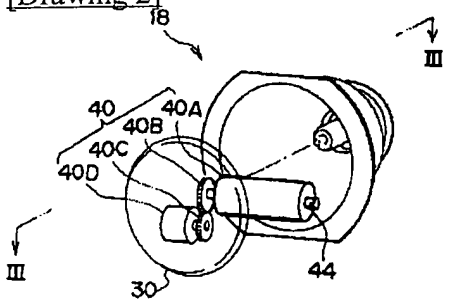
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

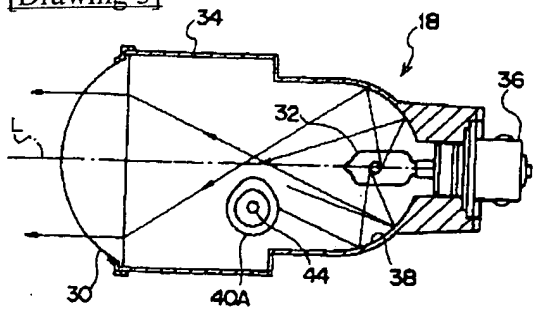
[Drawing 1]



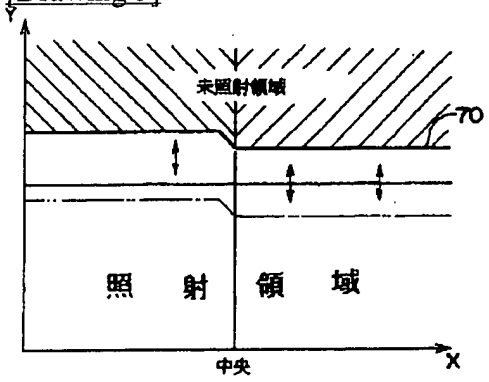
[Drawing 2]



[Drawing 3]

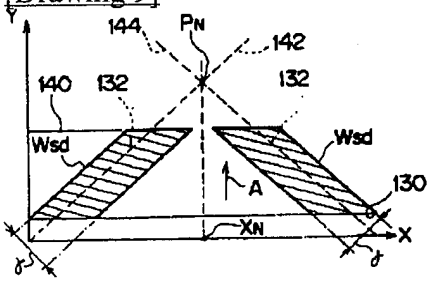


[Drawing 5]

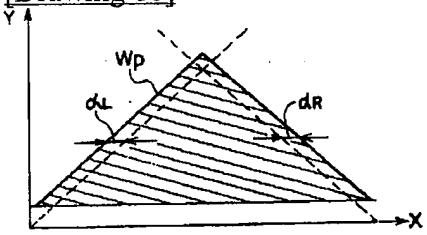


７０　カットライン

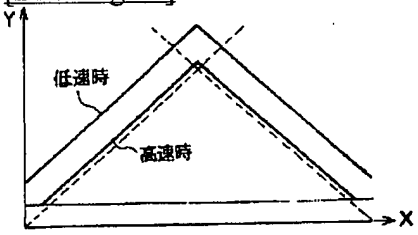
[Drawing 9]



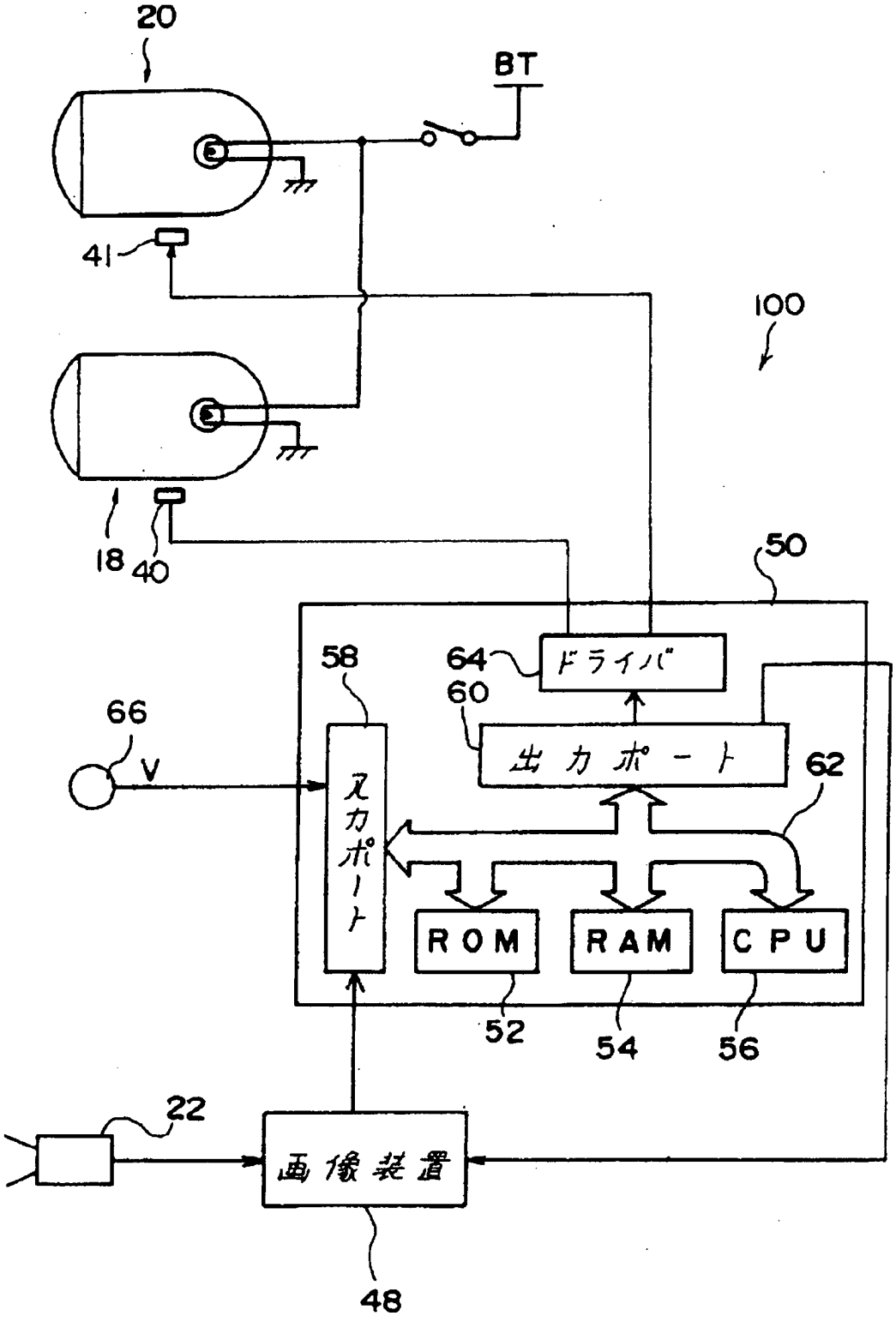
[Drawing 10]



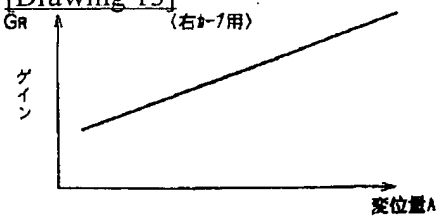
[Drawing 11]



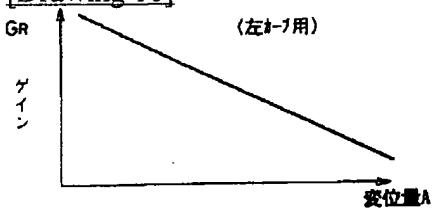
[Drawing 4]


20
BT
41
100
18
40
50
58
64
ドライバ
60
66
V
出力ポート
62
入力ポート
ROM
RAM
CPU
52
54
56
22
画像装置
48

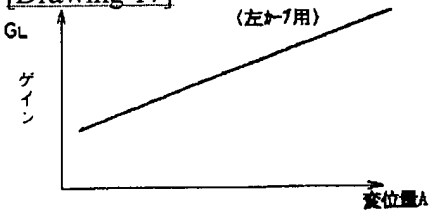
[Drawing 13]


GR
(右ｶｰﾌﾞ用)
ゲイン
変位量A

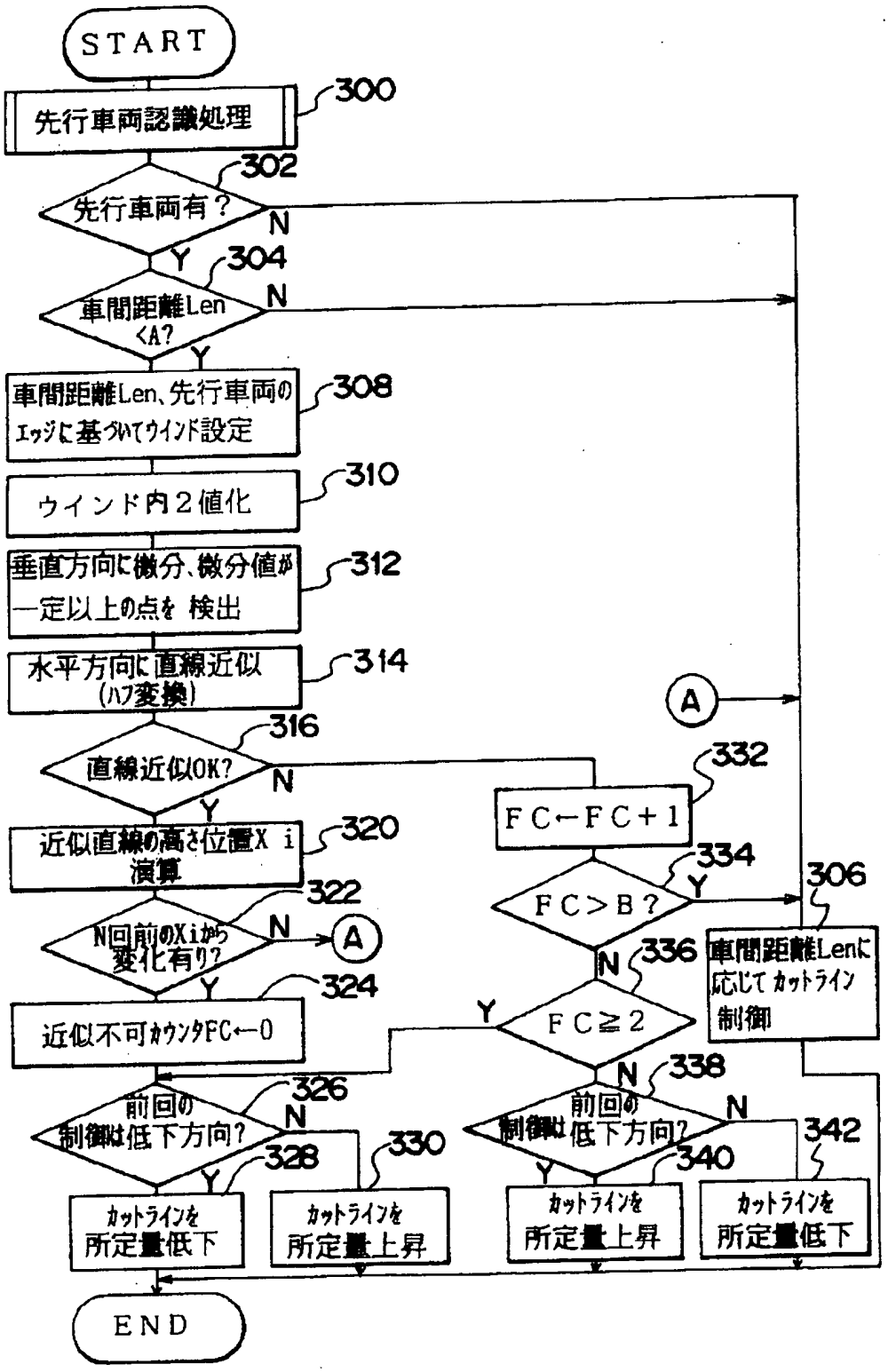
[Drawing 16]



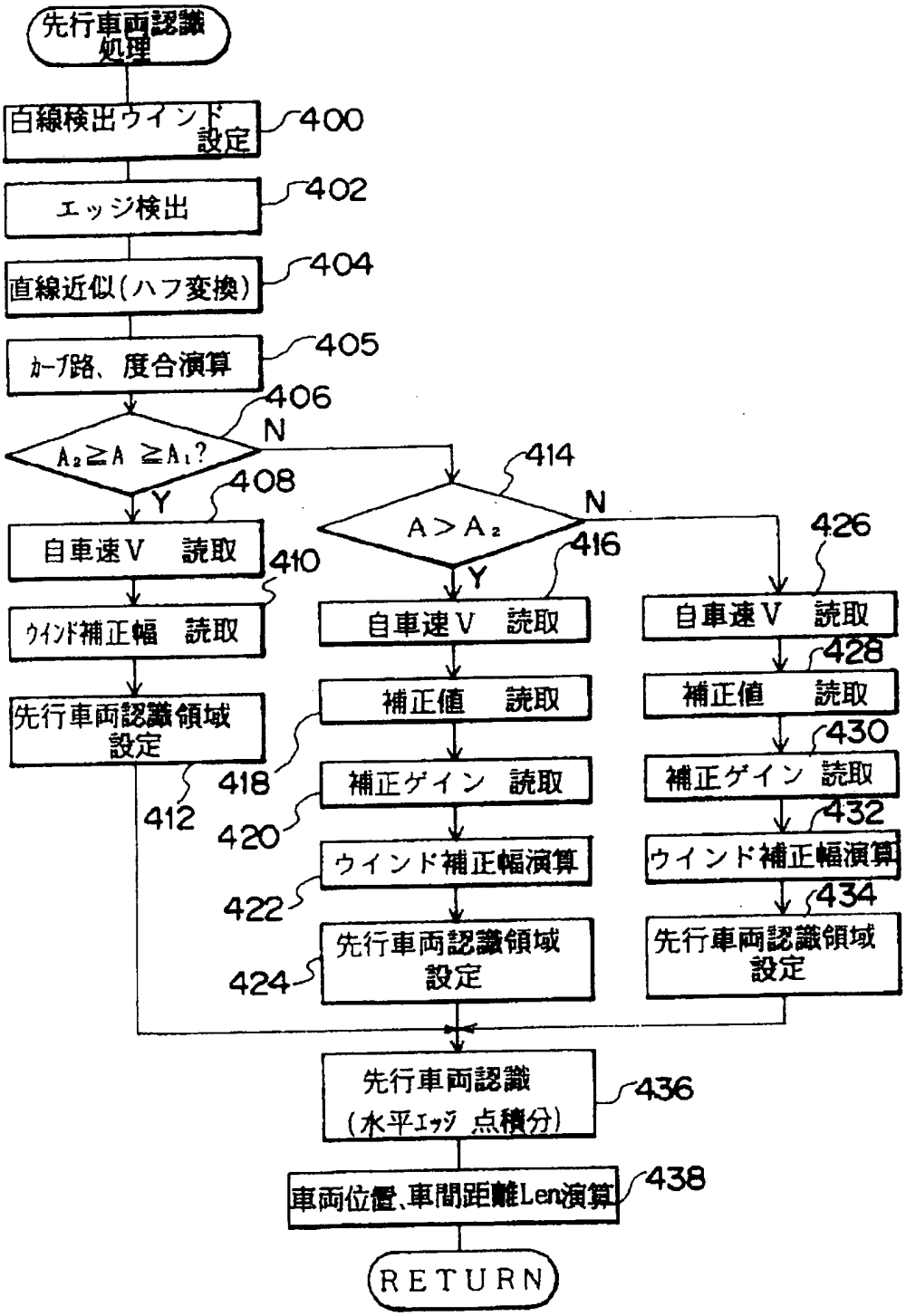
[Drawing 17]



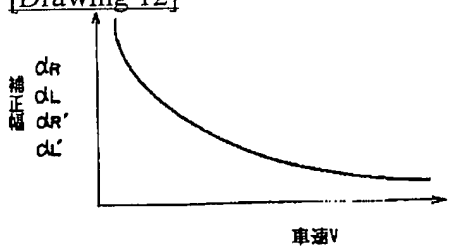
[Drawing 6]


START
先行車両認識処理
300
先行車両有？
302
N
Y
車間距離Len<A?
304
N
Y
車間距離Len、先行車両のエッジに基づいてウインド設定
308
ウインド内２値化
310
垂直方向に微分、微分値が一定以上の点を 検出
312
水平方向に直線近似(ハフ変換)
314
直線近似OK?
316
N
Y
近似直線の高さ位置X i 演算
320
N回前のXiから変化有り?
322
N
A
Y
近似不可カウンタFC←0
324
前回の制御は低下方向?
326
N
Y
カットラインを所定量低下
328
カットラインを所定量上昇
330
A
FC←FC+1
332
FC>B?
334
Y
306
車間距離Lenに応じてカットライン制御
N
FC≧2
336
Y
N
前回の制御は低下方向?
338
N
Y
カットラインを所定量上昇
340
カットラインを所定量低下
342
END

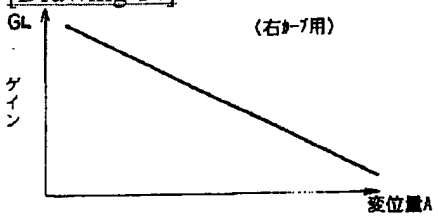
[Drawing 7]


先行車両認識処理
白線検出ウインド設定
400
エッジ検出
402
直線近似(ハフ変換)
404
カーブ路、度合演算
405
406
A2≧A≧A1?
N
Y
408
自車速V 読取
410
ウインド補正幅 読取
先行車両認識領域設定
412
418
420
422
424
414
A>A2
N
Y
自車速V 読取
補正値 読取
補正ゲイン 読取
ウインド補正幅演算
先行車両認識領域設定
416
426
自車速V 読取
428
補正値 読取
430
補正ゲイン 読取
432
ウインド補正幅演算
434
先行車両認識領域設定
先行車両認識
(水平エッジ 点積分)
436
車両位置、車間距離Len演算
438
RETURN

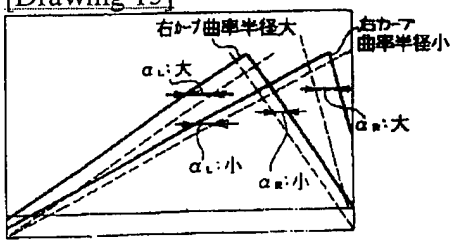
[Drawing 12]


補正幅
dR
dL
dR'
dL'
車速V

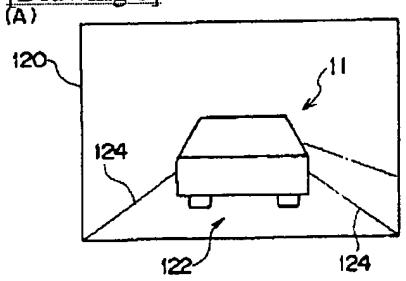
[Drawing 14]

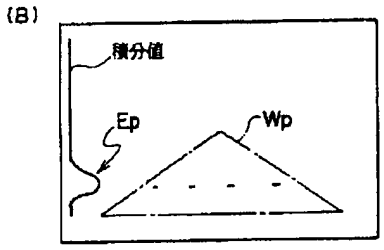


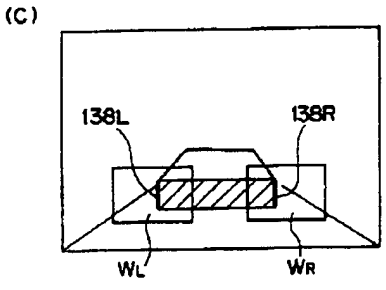
[Drawing 15]



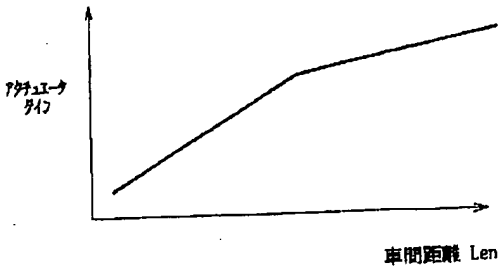
[Drawing 8]





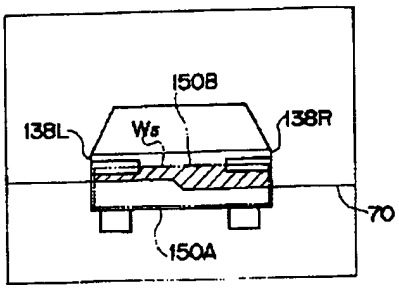


[Drawing 18]

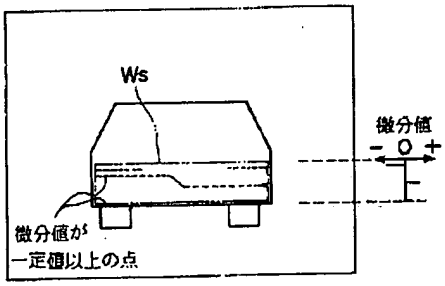


[Drawing 19]

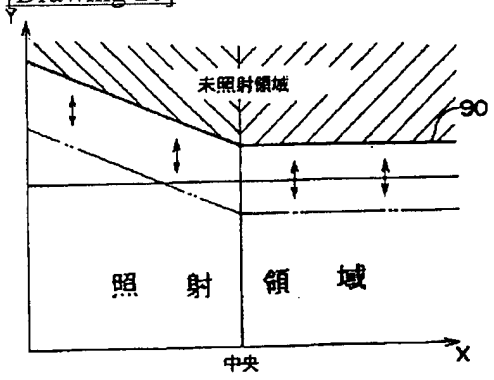
(A)



(B)



[Drawing 20]



90 カットライン

[Translation done.]